Amendments to the Claims:

Please cancel claims 2040, and 2079 without prejudice.

Please amend the claims as follows:

1-2038 (cancelled):

2039. (currently amended): A method of treating a coal formation in situ, comprising:

providing heat from ~~one or more~~ heaters positioned in heater wells to at least a portion of the formation;

allowing the heat to transfer from the ~~one or more~~ heaters to a part of the formation; wherein superposition of heat from at least two of the heaters pyrolyzes some hydrocarbons in the part of the formation;

wherein the part of the formation has been selected for heating using a moisture content in the part of the formation, and wherein at least a portion of the part of the formation comprises a moisture content of less than about 15%; and

producing a mixture from the formation.

2040. (cancelled):

2041. (currently amended): The method of claim 2039, further comprising maintaining a temperature ~~within~~ in the part of the formation ~~within~~ in a pyrolysis temperature range.

2042. (currently amended): The method of claim 2039, wherein at least one of the ~~one or more~~ heaters comprises an electrical heater.

2043. (cancelled):

2044. (currently amended): The method of claim 2039, wherein at least one of the ~~one or more~~ heaters comprises a flameless distributed combustor.

2045. (currently amended): The method of claim 2039, wherein at least one of the ~~one or more~~ heaters comprises a natural distributed combustor.

2046. (currently amended): The method of claim 2039, further comprising controlling a pressure and a temperature ~~within~~ in at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

2047. (previously amended): The method of claim 2039, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day during pyrolysis.

2048. (currently amended): The method of claim 2039, wherein providing heat from the ~~one or more~~ heaters to at least the portion of the coal formation comprises:

heating a selected volume (V) of the coal formation from the ~~one or more~~ heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons ~~within~~ in the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is an average formation bulk density, and wherein an average heating rate (h) of the selected volume is about 10 °C/day.

2049. (original): The method of claim 2039, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

2050. (previously amended): The method of claim 2039, wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).

2051. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons having an API gravity of at least about 25°.

2052. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the condensable hydrocarbons are olefins.

2053. (original): The method of claim 2039, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

2054. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is nitrogen.

2055. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is oxygen.

2056. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is sulfur.

2057. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons comprise oxygen containing compounds, and wherein the oxygen containing compounds comprise phenols.

2058. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, and wherein greater than about 20 % by weight of the condensable hydrocarbons are aromatic compounds.

2059. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 5 % by weight of the condensable hydrocarbons comprises multi-ring aromatics with more than two rings.

2060. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 0.3 % by weight of the condensable hydrocarbons are asphaltenes.

2061. (original): The method of claim 2039, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons are cycloalkanes.

2062. (previously amended): The method of claim 2039, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

2063. (original): The method of claim 2039, wherein the produced mixture comprises ammonia, and wherein greater than about 0.05 % by weight of the produced mixture is ammonia.

2064. (original): The method of claim 2039, wherein the produced mixture comprises ammonia, and wherein the ammonia is used to produce fertilizer.

2065. (currently amended): The method of claim 2039, further comprising controlling a pressure ~~within~~ in at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

2066. (currently amended): The method of claim 2039, further comprising controlling formation conditions to produce the mixture, wherein a partial pressure of H_2 ~~within~~ in the mixture is greater than about 0.5 bar.

2067. (currently amended): The method of claim 2066, wherein the partial pressure of H_2 ~~within~~ in the mixture is determined ~~measured when the mixture is~~ at conditions of a production well.

2068. (currently amended): The method of claim 2039, further comprising altering a pressure ~~within~~ in the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

2069. (currently amended): The method of claim 2039, further comprising ~~controlling formation conditions by~~ recirculating a portion of hydrogen from the mixture into the formation.

2070. (currently amended): The method of claim 2039, further comprising:

providing hydrogen (H_2) to the heated part of the formation to hydrogenate hydrocarbons ~~within~~ in the part of the formation; and

heating a portion of the part of the formation with heat from hydrogenation.

2071. (original): The method of claim 2039, further comprising:

producing hydrogen and condensable hydrocarbons from the formation; and

hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

2072. (previously amended): The method of claim 2039, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

2073. (previously amended): The method of claim 2039, wherein allowing the heat to transfer increases a permeability of at least a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

2074. (original): The method of claim 2039, further comprising controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by Fischer Assay.

2075. (previously amended): The method of claim 2039, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heaters are disposed in the formation for each production well.

2076. (currently amended): The method of claim 2039, ~~further comprising providing heat from three or more heaters to at least a portion of the formation,~~ wherein three or more of the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.

2077. (currently amended): The method of claim 2039, ~~further comprising providing heat from three or more heaters to at least a portion of the formation,~~ wherein three or more of the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

2078. (currently amended): A method of treating a coal formation in situ, comprising:

providing heat from ~~one or more~~ heaters positioned in heater wells to a part of the formation;

allowing the heat to transfer from the ~~one or more~~ heaters to the part of the formation;

wherein superposition of heat from at least two of the heaters pyrolyzes some hydrocarbons in the part of the formation;

wherein at least a portion of the part of the formation has an initial moisture content of less than about 15%; and

producing a mixture from the formation.

2079. (cancelled):

2080. (currently amended): The method of claim 2078, further comprising maintaining a temperature ~~within~~ in the part of the formation ~~within~~in a pyrolysis temperature range.

2081. (currently amended): The method of claim 2078, wherein at least one of the ~~one or more~~ heaters comprises an electrical heater.

2082. (cancelled):

2083. (currently amended): The method of claim 2078, wherein at least one of the ~~one or more~~ heaters comprises a flameless distributed combustor.

2084. (currently amended): The method of claim 2078, wherein at least one of the ~~one or more~~ heaters comprises a natural distributed combustor.

2085. (currently amended): The method of claim 2078, further comprising controlling a pressure and a temperature ~~within~~ in at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

2086. (previously amended): The method of claim 2078, further comprising controlling the heat such that an average heating rate of the part of the formation is less than about 1 °C per day during pyrolysis.

2087. (currently amended): The method of claim 2078, wherein providing heat from the ~~one or more~~ heaters to at least the portion of the coal formation comprises:

heating a selected volume (V) of the coal formation from the ~~one or more~~ heaters, wherein the formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some hydrocarbons ~~within~~ in the selected volume of the formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is an average formation bulk density, and wherein the heating rate (h) of the selected volume is about 10 °C/day.

2088. (original): The method of claim 2078, wherein allowing the heat to transfer comprises transferring heat substantially by conduction.

2089. (previously amended): The method of claim 2078, wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C).

2090. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons having an API gravity of at least about 25°.

2091. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 0.1 % by weight to about 15 % by weight of the condensable hydrocarbons are olefins.

2092. (original): The method of claim 2078, wherein the produced mixture comprises non-condensable hydrocarbons, and wherein a molar ratio of ethene to ethane in the non-condensable hydrocarbons ranges from about 0.001 to about 0.15.

2093. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is nitrogen.

2094. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is oxygen.

2095. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 1 % by weight, when calculated on an atomic basis, of the condensable hydrocarbons is sulfur.

2096. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons comprise oxygen containing compounds, and wherein the oxygen containing compounds comprise phenols.

2097. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, and wherein greater than about 20 % by weight of the condensable hydrocarbons are aromatic compounds.

2098. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 5 % by weight of the condensable hydrocarbons comprises multi-ring aromatics with more than two rings.

2099. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, and wherein less than about 0.3 % by weight of the condensable hydrocarbons are asphaltenes.

2100. (original): The method of claim 2078, wherein the produced mixture comprises condensable hydrocarbons, and wherein about 5 % by weight to about 30 % by weight of the condensable hydrocarbons are cycloalkanes.

2101. (previously amended): The method of claim 2078, wherein the produced mixture comprises a non-condensable component, wherein the non-condensable component comprises molecular hydrogen, wherein the molecular hydrogen is greater than about 10 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure, and wherein the molecular hydrogen is less than about 80 % by volume of the non-condensable component at 25 °C and one atmosphere absolute pressure.

2102. (original): The method of claim 2078, wherein the produced mixture comprises ammonia, and wherein greater than about 0.05 % by weight of the produced mixture is ammonia.

2103. (original): The method of claim 2078, wherein the produced mixture comprises ammonia, and wherein the ammonia is used to produce fertilizer.

2104. (previously amended): The method of claim 2078, further comprising controlling a pressure within at least a majority of the part of the formation, wherein the controlled pressure is at least about 2.0 bar absolute.

2105. (currently amended): The method of claim 2078, further comprising controlling formation conditions to produce the mixture, wherein a partial pressure of H_2 ~~within~~ in the mixture is greater than about 0.5 bar.

2106. (currently amended): The method of claim 2105, wherein the partial pressure of H_2 ~~within~~ in the mixture is ~~measured~~ determined~~when the mixture is~~ at conditions of a production well.

2107. (currently amended): The method of claim 2078, further comprising altering a pressure ~~within~~ in the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25.

2108. (currently amended): The method of claim 2078, further comprising ~~controlling formation conditions by~~ recirculating a portion of hydrogen from the mixture into the formation.

2109. (currently amended): The method of claim 2078, further comprising:

providing hydrogen (H_2) to the heated part of the formation to hydrogenate hydrocarbons ~~within~~ in the part of the formation; and

heating a portion of the part of the formation with heat from hydrogenation.

2110. (original): The method of claim 2078, further comprising:

producing hydrogen and condensable hydrocarbons from the formation; and

hydrogenating a portion of the produced condensable hydrocarbons with at least a portion of the produced hydrogen.

2111. (previously amended): The method of claim 2078, wherein allowing the heat to transfer increases a permeability of a majority of the part of the formation to greater than about 100 millidarcy.

2112. (previously amended): The method of claim 2078, wherein allowing the heat to transfer increases a permeability of at least a majority of the part of the formation such that the permeability of the majority of the part is substantially uniform.

2113. (original): The method of claim 2078, further comprising controlling the heat to yield greater than about 60 % by weight of condensable hydrocarbons, as measured by Fischer Assay.

2114. (previously amended): The method of claim 2078, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heaters are disposed in the formation for each production well.

2115. (currently amended): The method of claim 2078, ~~further comprising providing heat from three or more heaters to at least a portion of the formation,~~ wherein three or more of the heaters are located in the formation in a unit of heaters, and wherein the unit of heaters comprises a triangular pattern.

2116. (currently amended): The method of claim 2078, ~~further comprising providing heat from three or more heaters to at least a portion of the formation,~~ wherein three or more of the heaters are located in the formation in a unit of heaters, wherein the unit of heaters comprises a triangular pattern, and wherein a plurality of the units are repeated over an area of the formation to form a repetitive pattern of units.

2117 - 5149 (cancelled):

5150. (currently amended): A method of treating a coal formation in situ, comprising:

evaluating a moisture content of coal in the coal formation to identify a portion of the coal with a moisture content that is less than about 20%;

providing heat from ~~one or more~~ heaters positioned in heater wells to the portion to heat the portion so that an average temperature in the portion is above a temperature sufficient to pyrolyze coal in the portion;

wherein superposition of heat from at least two of the heaters pyrolyzes some hydrocarbons in the part of the formation; and

producing a mixture from the coal formation.

5151. (currently amended): The method of claim 5150, further comprising controlling a pressure and a temperature ~~within~~ in at least a majority of the portion, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure.

5152. (currently amended): The method of claim 5150, wherein providing heat ~~from one or more~~the heaters to the portion comprises providing heat to a portion of the coal identified as having a moisture content that is less than about 15%.

5153. (currently amended): The method of claim 5150, wherein providing heat from ~~one or more~~the heaters to the portion comprises providing heat to a portion of the coal identified as having a moisture content that is less than about 10%.

5154. (currently amended): The method of claim 5150, wherein producing the mixture comprises producing the mixture in a production well, and wherein at least about 7 heaters are disposed in the formation for each production well.

5155. (currently amended): The method of claim 5150, wherein providing heat from the ~~one or more~~ heaters to at least the portion of the coal formation comprises:

heating a selected volume (V) of the coal formation from the ~~one or more~~ heaters, wherein the coal formation has an average heat capacity (C_v), and wherein the heating pyrolyzes at least some coal ~~within~~ in the selected volume of the coal formation; and

wherein heating energy/day (Pwr) provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is an average formation bulk density, and wherein an average heating rate (h) of the selected volume is less than about 10 °C/day.

5156. (new): The method of claim 5150, wherein the mixture comprises H_2, and introducing a portion of the hydrogen into the coal formation.

5157. (new): The method of claim 5150, wherein the mixture comprises H_2 and condensable hydrocarbons, and hydrogenating condensable hydrocarbons of the mixture with H_2 from the mixture.

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5158. (new): The method of claim 2039, further comprising providing H_2 to at least a portion of the formation.

5159. (new): The method of claim 2078, further comprising providing H_2 to at least a portion of the formation.

Response to Office Action Mailed May 5, 2003

A. Pending Claims

Claims 2039, 2041, 2042, 2044-2078, 2080, 2081, 2083-2116, and 5150-5157 are pending. Claims 2039, 2041, 2042, 2044-2046, 2048, 2065-2070, 2076, 2077, 2078, 2080, 2081, 2083-2085, 2087, 2105-2109, 2115, 2116, and 5150-5155 have been amended. Claims 2041, 2042, 2044-2046, 2048, 2065-2070, 2076, 2077, 2080, 2081, 2083-2085, 2087, 2105-2109, 2115, 2116 and 5151-5155 have been amended for clarification and/or correction of typographical errors. Claims 2040 and 2079 have been cancelled. Claims 5156-5159 are new.

B. The Claims Are Not Obvious Over Puri Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2039, 2041, 2042, 2049-2053, 2057-2064, 2066, 2067, 2072-2074, 2078, 2080, 2081, 2083, 2088-2092, 2096-2103, 2105, 2106, 2111-2113, 5150, 5152, and 5153 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,537,252 to Puri (hereinafter "Puri") in view of U.S. Patent No. 3,924,680 to Terry (hereinafter "Terry") and "Coalbed Methane: Principles and Practice". Applicant respectfully disagrees with these rejections.

The Examiner states:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to have practiced the Puri method on a coal formation having a moisture content less than 15%, as called for in claim 2039, since moisture is a nuisance in such processes, and since may coal seams have moisture values below 15%.

The Examiner makes similar statements about claim 2078.

Features of claims 2040 and 2079, including subject matter allowable over the prior art, have been incorporated into claims 2039, 2078, and 5150. Amended claims

2039, 2078, and 5150 describe a combination of features including: "wherein superposition of heat from at least two of the heaters pyrolyzes some hydrocarbons in the part of the formation". Applicant submits that the combination of the cited references does not appear to teach or suggest at least the above-quoted features of claims 2039, 2078, and 5150. Applicant respectfully requests removal of the rejections of claims 2039, 2078, and 5150.

If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Applicants respectfully requests removal of the rejections of claims dependent on claims 2039, 2078, and 5150. Applicant submits, in addition, that claims dependent on claims 2039 and 2078 are separately patentable.

In order to reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011, 154 U.S.P.Q. 173, 177-178 (C.C.P.A. 1967). To establish a *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974), MPEP § 2143.03.

The Examiner states: "With regards to claim 2050; most coals inherently have thermal conductivities greater than about 0.5 W/(m°C). Furthermore, since applicant has not disclosed any special features of the heating which increase the conductivity; it is apparent that any heating of coal will increase the thermal conductivity." The Examiner makes a similar statement regarding claim 2089.

Claims 2050 and 2089 describe a combination of features including: "wherein allowing the heat to transfer to the part of the formation heats the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C)." Applicant submits that heating of the pyrolysis zone to increase a thermal conductivity of a portion of the pyrolysis zone to greater than about 0.5 W/(m °C) is unexpected

based on literature in the art. For example, Applicant's Specification states:

> Certain embodiments described herein will in many instances be able to economically treat formations that were previously believed to be uneconomical. Such treatment will be possible because of the surprising increases in thermal conductivity and thermal diffusivity that can be achieved with such embodiments. These surprising results are illustrated by the fact that prior literature indicated that certain coal formations exhibited relatively low values for thermal conductivity and thermal diffusivity when heated. For example, in government report No. 8364 by J. M. Singer and R. P. Tye entitled "Thermal, Mechanical, and Physical Properties of Selected Bituminous Coals and Cokes," U.S. Department of the Interior, Bureau of Mines (1979), the authors report the thermal conductivity and thermal diffusivity for four bituminous coals. This government report includes graphs of thermal conductivity and diffusivity that show relatively low values up to about 400 °C (e.g., thermal conductivity is about 0.2 W/(m °C) or below, and thermal diffusivity is below about 1.7×10^{-3} cm^2/s). This government report states that "coals and cokes are excellent thermal insulators."
>
> In contrast, in certain embodiments described herein coal may be treated such that the thermal conductivity and thermal diffusivity are significantly higher (e.g., thermal conductivity at or above about 0.5 W/(m °C) and thermal diffusivity at or above 4.1×10^{-3} cm^2/s) than would be expected based on previous literature such as government report No. 8364. If treated as described in certain embodiments herein, coal does not act as "an excellent thermal insulator." Instead, heat can and does transfer and/or diffuse into the formation at significantly higher (and better) rates than would be expected according to the literature, thereby significantly enhancing economic viability of treating the formation. (Specification, page 136, lines 8-29)

Thus, Applicant submits that heating the part of the formation to increase a thermal conductivity of at least a portion of the part of the formation to greater than about 0.5 W/(m °C) is not an obvious matter of choice or design. Applicant respectfully requests removal of the rejections of claims 2050 and 2089.

C. The Claims Are Not Obvious Over Puri Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claims 2068 and 2107 under 35 U.S.C. 103(a) as being unpatentable over Puri in view of Terry and "Coalbed Methane: Principles and Practice" and

further in view of U.S. Patent No. 6,016,867 to Gregoli (hereinafter "Gregoli"). Applicant respectfully disagrees with these rejections.

The Examiner states:

> The Puri reference fails to teach the altering pressure to inhibit production of hydrocarbons having carbon numbers greater than about 25. The Gregoli reference teaches that in a similar in-situ processes, it is beneficial to use high pressure to break heavy hydrocarbons. It is well known that carbons having carbon numbers greater tan about 25 are considered heavy; and impede production because they are dense and viscous. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the Puri method to have included altering pressure to inhibit production of hydrocarbons having carbon numbers greater than about 25, as called for in claims 2068 and 2107, in order to improve production.

Amended claims 2068 and 2107 describe a combination of features including: "altering a pressure within the formation to inhibit production of hydrocarbons from the formation having carbon numbers greater than about 25." Gregoli discloses: "conditions necessary for sustaining the hydrovis-breaking reaction are achieved by injecting superheated steam and hot reducing gases, comprised principally of hydrogen, to heat the formation to a preferred temperature and to maintain a preferred level of hydrogen partial pressure." (Gregoli, col. 2, lines 32-37) Gregoli appears to teach the use of steam and a reducing gas for "hydrovis-breaking reactions". The combination of cited art does not appear to teach or suggest inhibiting production of hydrocarbons having carbon numbers greater than about 25 by altering pressure within the formation. Applicant respectfully requests removal of the rejections of claims 2068 and 2107.

D. <u>The Claims Are Not Obvious Over Puri Pursuant To 35 U.S.C. § 103(a)</u>

The Examiner rejected claims 2046, 2085, and 5151 under 35 U.S.C. 103(a) as being unpatentable over Puri in view of Terry and "Coalbed Methane: Principles and Practice" and further in view of U.S. Patent No. 2,734,579 to Elkins (hereinafter "Elkins"). Applicant respectfully disagrees with these rejections.

The Examiner states:

> Elkins teaches controlling the pressure in order to lower the temperature (col. 3, line 46); this is done in order to help prevent overheating. It would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the Puri process to have included the temperature is controlled as a function of the pressure or the pressure is controlled as a function of the temperature as called for in claims 2046, 2085, and 5151 as taught by Elkins, in order to prevent overheating.

Elkins discloses:

> Control of the temperature within the reaction zone can be maintained in several ways. The increase in volume of oxygen-containing gas by application of higher injection gas pressure will increase this temperature.... To keep the temperature from becoming too high, it is possible to dilute the air with inert gas, for example, by separating the inert gaseous products of combustion (principally oxides of nitrogen and carbon) from the produced hydrocarbons, and introducing it into the injection stream.... Decreasing the injection gas pressure also decreases the combustion zone temperature (Elkins, col. 3, lines 26-46).

Amended claims 2046, 2085, and 5151 describe a combination of features including: "controlling a pressure and a temperature in at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure."

Elkins does not appear to teach or suggest controlling a pressure and a temperature in at least a majority of the part of the formation, wherein the pressure is controlled as a function of temperature, or the temperature is controlled as a function of pressure. Applicant respectfully submits that the above-quoted features do not appear to be taught or suggested by the cited art. Applicant respectfully requests removal of the rejections of claims 2046, 2085, and 5151.

E. Claim 5155 Is Not Obvious Over Puri Pursuant To 35 U.S.C. § 103(a)

The Examiner rejected claim 5155 under 35 U.S.C. 103(a) as being unpatentable over Puri in view of Terry and "Coalbed Methane: Principles and Practice" and further in view of U.S. Patent No. 4,457,365 to Kasevich (hereinafter "Kasevich"). Applicant respectfully disagrees with this rejection.

The Examiner states:

> The Puri reference fails to teach the heating rate. It is known to heat at rates of less than 10°C per day, as shown by Kasevich (figure 3). It is apparent that this low heating rate is desirable because it results in more uniform heating, and reduces the possibility of hot spots. It would have been obvious to one of ordinary skill in the art at the time of the invention to have further modified the Puri method to have included heating at a rate of less than about 10°C per day as called for in claim 5155, in order to achieve more uniform heating. The claim limitations drawn to the heating energy are nothing more than well known thermodynamic equations.

Kasevich states:

> The process and apparatus for extracting the products of kerogen in situ from an oil shale body by supplying energy selectively to the kerogen by high frequency electric fields in the frequency range between 100 kilohertz and 1000 megahertz at an intensity which heats the kerogen to a temperature range between 250° C. and 500° C. to allow pyrolysis of the kerogen prior to substantial heat transfer to the surrounding mineral portions of the oil shale. A plurality of groups of spaced radiators produce the electric fields for heating the kerogen. A dipole radiator in the subsurface formation is supplied with electromagnetic energy through a transmission line from an energy generator on the surface. (Kasevich, abstract)

Kasevich further states:

> In dry oil shale, the conductivity continues to be reduced, as shown by the curve portions 108, reaching a minimum approaching, for example, 10^{-4} mhos per meter at a temperature around 250° C. as shown by curve 112. In this region the major portion of the power is absorbed by the kerogen as shown by

> curve 118, which assumes sufficiently rapid rise in temperature that no pyrolysis has yet taken place and the conductivity of the inorganic or mineral portion of the oil shale approaches 10^{-5} mhos per meter as shown by curve 116.
>
> As shown by the portions of the formation conductivity curves 114, 120, 122, and 124, different radiation rates produce different energy absorption increases with temperature above 250° C. due partly to conversion of the kerogen to higher conductivity products. (Kasevich, col. 7, line 66 through col. 8, line 13)

Amended claim 5155 describes a combination of features including: "wherein heating energy/day *(Pwr)* provided to the selected volume is equal to or less than $h*V*C_v*\rho_B$, wherein ρ_B is formation bulk density, and wherein an average heating rate of the formation (h) is about 10 °C/day." The cited art does not appear to teach or suggest using a desired heating rate to calculate a maximum amount of heating energy/day to be applied to a selected volume of a formation. Applicant respectfully requests removal of the rejection of claim 5155.

F. Provisional Double Patenting Rejection

The Examiner provisionally rejected claims 2039-2042, 2044-2081, 2083-2116, and 5150-5155 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims in copending Application Nos. 09/840,937; 09/841,170; 09/841,288; 09/841,291; 09/841,300; 09/841,432; 09/841,438; 09/841,445; 09/841,495; 09/841,638; and 09/841,639. Upon allowance of the present application but for the double patenting rejection, Applicant will provide a terminal disclaimer or supply arguments why the double patenting rejection is inappropriate.

G. Additional Remarks

Applicant submits that all claims are in condition for allowance. Favorable consideration is respectfully requested.

Applicant believes no fees are due with the filing of this and accompanying documents. If any extension of time is needed, Applicant requests the appropriate extension of time. If any

fees are required, please charge those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5659-05900/EBM.

Respectfully submitted,

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